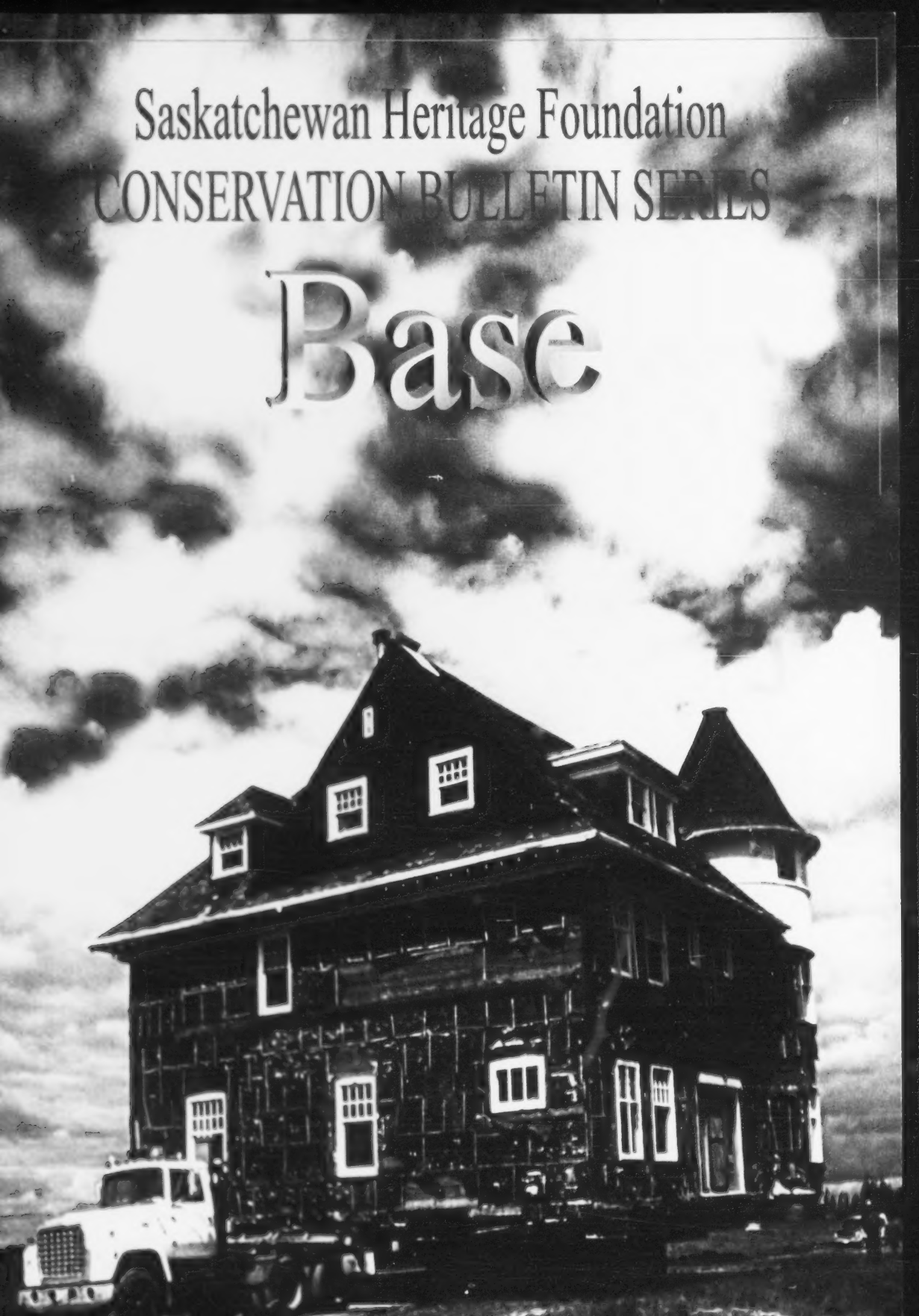
Saskatchewan Heritage Foundation

CONSERVATION BULLETIN SERIES

Base



Base - This Conservation Bulletin is a resource guide for some of the most common foundation issues found in Saskatchewan heritage structures.

Cover Photo - BANBURY RESIDENCE, WOLSELEY SK / Korvemaker

Canada's Historic Places | Lieux patrimoniaux du Canada

Saskatchewan Heritage

CONTENTS

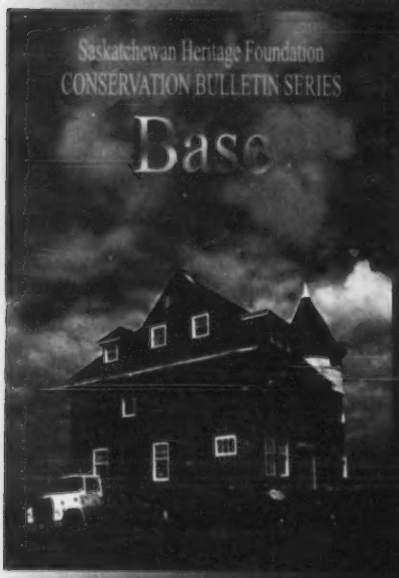
1. Introduction

2. Standards and Guidelines

3. Repair and Maintenance

4. Visual Inspection

5. Sample Sources



The Saskatchewan Heritage Foundation (SHF) is a Crown Corporation established by provincial legislation in 1991 to support heritage projects at the provincial and community level that conserve, research, interpret, develop and promote Saskatchewan's diverse heritage resources.

The Heritage Resources Branch of the Ministry of Tourism, Parks, Culture and Sport leads the protection and conservation of heritage resources in Saskatchewan through inventory, research, and consultative programs and services under *The Heritage Property Act*.

The Historic Places Initiative (HPI) - represents a collaboration of Canada's federal, provincial and territorial governments to: engage Canadians in the conservation of historic places; foster collaborations to build capacity and a credible and coherent heritage management system; and provide incentives to mobilize Canadian support of heritage conservation.

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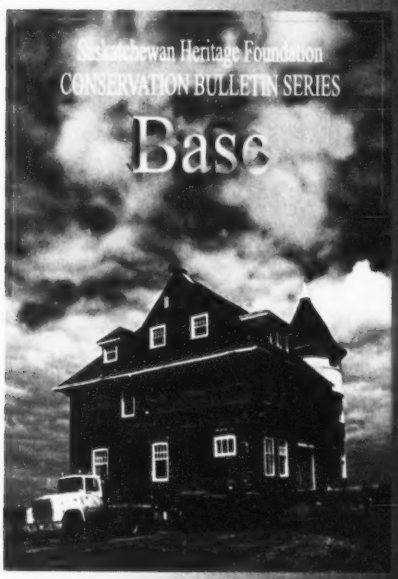

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INTRODUCTION

Foundation issues common in Saskatchewan primarily relate to deterioration and movement caused by the effects of moisture on foundation materials and the surrounding soil. Complex heritage property maintenance and repair decisions such as those related to foundations, roofing and structural systems, and code requirements tend to receive greater deference to expert professional opinion than decisions about decorative treatments. However, appropriate treatment of the character defining elements that provide heritage meaning to a property requires coordination of decisions about the project as an integrated whole and impacts almost all aspects of a project's design, construction processes, materials specifications, operations and maintenance planning.

This bulletin is intended as a companion volume to the Parks Canada *Standards and Guidelines for the Conservation of Historic Places in Canada,* referred to in this bulletin as the "standards and guidelines". These have been formally adopted by the SHF and inform decisions relating to the agency's granting activities. The standards and guidelines encourage a principled and informed approach that gives perspective and context to decisions which involve technical solutions.

There is a clear preference for processes that repair rather than replace; and, if replacement is necessary then replacement of "in kind" missing or deteriorated parts should be based on historical evidence. With foundations, however, this is not always practical. Higher quality materials and standards together with the need for structurally strong and stable foundations, and the fact that foundations are not always visible, have resulted in acceptable replacement foundations that meet modern standards with improved material mixes and methods.

SHF Conservation Bulletins encourage heritage building owners to become more knowledgeable to enable informed decision-making. Bulletins do not attempt to transform laypersons into qualified practitioners. Professional technicians, contractors, engineers or architects should be hired to properly assess and undertake foundation repairs.
Through the use of Saskatchewan examples, bulletins encourage an understanding of the need to include properly trained professionals in the planning and application of repair and maintenance interventions when dealing with heritage property.

The many factors that interact to cause the need for repair and improved maintenance practices can only be identified by visiting the site and taking time to knowledgeably review and assess the situation. Repair and maintenance issues do not arise in isolation from the rest of the structure, site or environment. Solutions should be developed as a result of viewing the problem and the choice of solution in the context of a planned approach to the structure as a whole.

SHF Conservation Bulletins advocate hiring qualified practitioners who can base their assessments on comprehensive site reviews to determine the causes and correct treatment of foundation issues. Solutions should be developed as a result of viewing a problem and the choice of solutions in the context of a planned approach to the structure as a whole. This will result in solutions that address both the visible damage and the underlying causes.

"structural problems should be corrected prior to any associated work identified on the exterior of the building. It is common that structural problems uncovered at the foundation/basement areas contribute to failures found on the exterior."
Practical Preservation Programs, Community Planning, St. John N.B. http://www.saintjohn.ca/heritage-guidelines.cfm

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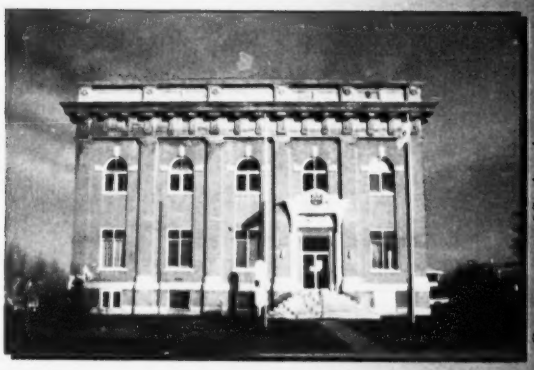
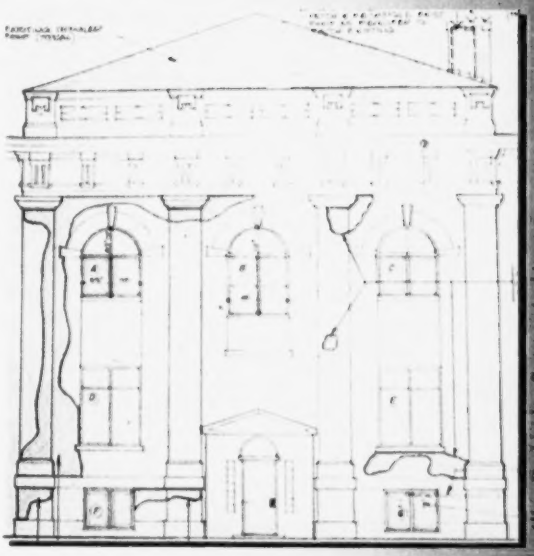


Government of Saskatchewan



Allan Duddridge-Stanilec Architecture

Government of Saskatchewan

Battleford Town Hall / Opera House (1912) *Water leakage at the top of the wall was a contributing cause to damage visible at the base of the building. http://www.battleford.ca/buildings.html#thoh*

Town Hall / Opera House, Battleford SK

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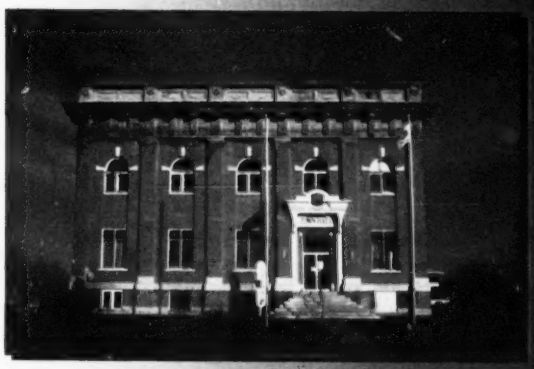

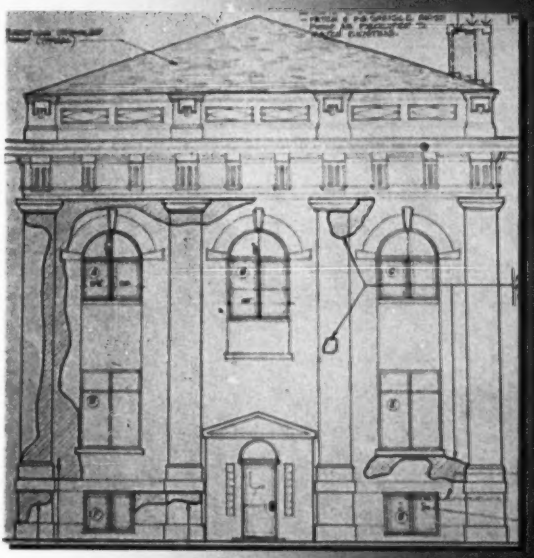

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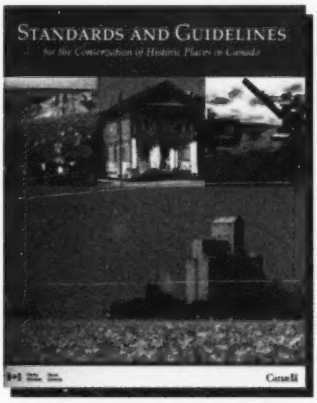
STANDARDS AND GUIDELINES

Above-grade stone foundation walls are important due their visibility and the contribution that they can make to a structure's heritage appearance. When repairing foundations it is important to address the causes of deterioration with interventions that are physically and visually compatible.

It is desirable to augment and retain original load bearing masonry or stone foundations, but this is not always possible due to a variety of site conditions including soil composition, site drainage characteristics, and load bearing requirements. At Stanley Mission's Holy Trinity Church (1854-1860), for example, the original stone foundation was replaced with a combined stone and cement foundation to provide an above-grade appearance compatible with the historic structure while increasing stability in areas not visible and below-grade for greater long-term stability.



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1. ***Understanding*** - Preserve character-defining elements: the materials, forms, location, spatial configurations, uses and cultural associations or meanings which must be retained in order to preserve value.

2. ***Planning*** - It is important to focus on the long term and maintain a strong awareness of the large picture. Planning must take into account all factors affecting the future of a historic place, including the owner's needs, resources and external constraints.

3. ***Using*** - The use of a historic place may be part of its heritage value, in which case, it must be maintained. Uses that are economically, socially or symbolically viable are the best guarantee of the long-term survival of a historic place.

4. ***Intervening*** - It is always better to preserve than to repair, and better to repair than replace. Any additions must respect the spirit and substance of the existing. A "minimal intervention" approach is the basis of conservation practice.

Foundation Treatments

Recommended - preservation of foundations from the perspective of documenting, stabilizing, protecting and maintaining structural systems and individual features that are important to defining heritage value. Also recommended is a maintenance plan to reduce the risk of deterioration in the future.

Not Recommended - failing to address the causes of foundation deterioration, and covering or radically changing visible features of heritage value.

Standards and Guidelines Philosophy

Understanding - Heritage value: the aesthetic, historic, scientific, cultural, social or spiritual importance or significance for past, present or future generations.

Planning - A process that connects comprehensive understanding of a place with interventions that will respect its heritage value.

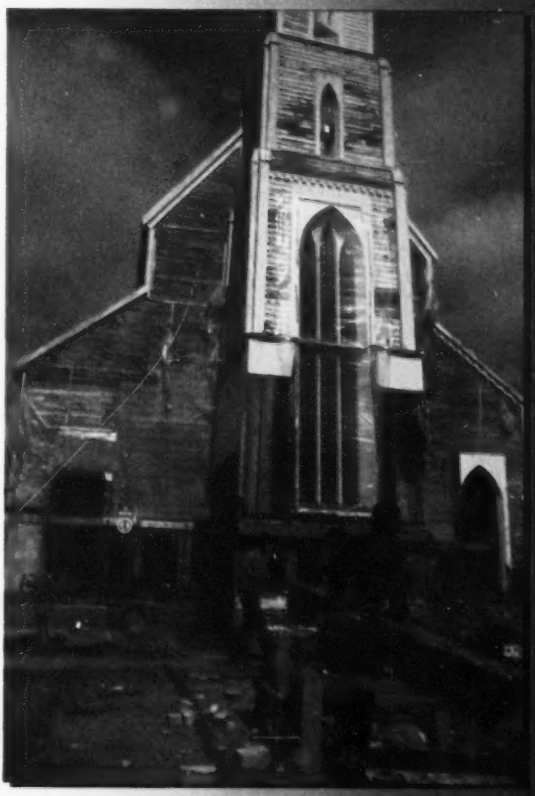
Using - Uses that are economically, socially or symbolically viable

Intervening - Intervention at a historic place must respect its heritage value and character-defining elements.

Holy Trinity Anglican Church, Stanley Mission SK (1854-1860)

This late nineteenth century archival photograph shows the church on its the original stone foundation. As decades passed, the foundation began moving with shifting soil conditions and the heavy post and sill construction of the wall structure was deteriorating due to rising damp.

In the photo below, the church has been raised and a new foundation has been built to support repair work to the heavy timber framing of the wall.



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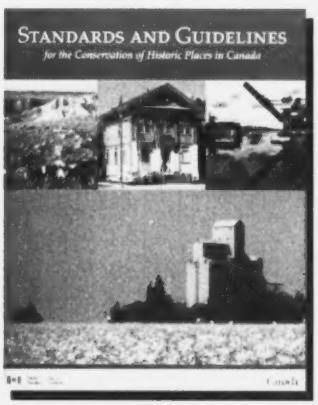

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Saskatchewan Archives Board

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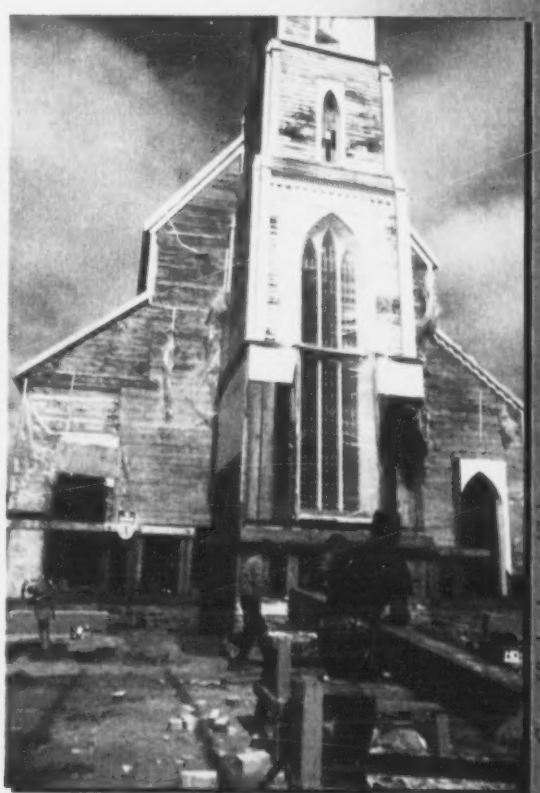

Gov. of Saskatchewan / Zelmer

Holy Trinity Church, Stanley Mission SK

REPAIR AND MAINTENANCE

Foundation damage might be the result of material failure due to a weak or deteriorated cement mix or inadequate design; but damage can also result from many other factors such as: inadequate site drainage, soil settlement, a high water table, tree roots, poor eave trough maintenance that concentrates water saturation, soil conditions, or unrelated activity adjacent to the site which is causing vibration and settlement. Additional causes of foundation deterioration could also include: subsurface ground movement, rising damp, improper site grading, fungal rot, condensation due to poor ventilation, insect and vermin infestations, and the proximity of vegetation and related irrigation systems to foundations. Changes to a structure's surroundings or function can also result in negative impacts on foundations. For example, a change of the type of occupancy could result in increased loads, new openings in the structure, interior climate change that might alter normal moisture content levels. Although many Saskatchewan heritage buildings have been continuously occupied, a change of use has impacted a variety of historic structures that have undergone dormant periods where they have remained unheated and poorly maintained especially during the winter. The beehive shaped kilns at the Claybank Brick Plant National Historic Site near Avonlea provide an example of the impact of a change of use. Once an industrial site where the kilns were regularly heated to extreme temperatures during the brick manufacturing process, the site is now a tourist attraction. The kilns are no longer used and the soil around the kilns has cooled; this has combined with exceptionally high ground water levels to result in increased dampness and efflorescence on the kilns' brick walls.

BARN AGAIN!

A NATIONAL PROGRAM TO PRESERVE HISTORIC FARM BUILDINGS

The Bell Farm barn (opposite) in Indian Head represents a type of historic structure that, as a result of time, history and the changing nature of the farming economy, was left unused. This impacted foundation conditions.

The National Trust for Historic Preservation publishes a "Barn Aid Series" (Barn Aid #1: Barn Foundations is available at http://www.preservationnation.org/issues/rural-heritage/barn-again/additional-resources/2008-BA-Catalog.pdf) - the series identifies that damage to barn foundations due to frost heave can occur when a barn is no longer used for livestock which causes a drop in the inside temperature; when this is combined with poor site grading to drain water away from the building, unrepaired eave troughs, and windows and doors left open during the winter, cold penetrates into the interior of the barn structure allowing moisture in basement walls and floors to freeze.

While historic buildings often settle over time, raising the grade level around a building through the addition of extra soil or organic materials can also give the appearance of the structure sinking further into the ground. Building settlement combined with an elevated site at the Trounce Residence in Saskatoon allowed water to potentially flow into the building or seep into the lower structure and cause water-related deterioration. The site has now been appropriately graded and drained.

Trounce Residence / Fehr

Trounce Residence / Flaman

Trounce Residence *(1883) is the oldest existing building in Saskatoon.*
http://www.saskatoonheritage.ca/designated_trounce_house.html

Bell Farm / Bruce Neill

Bell Farm (1882), Indian Head SK *- no longer used as a horse barn, the altered temperature and humidity levels combined with poor maintenance to enable cold penetration and deterioration of the structure to the point where it was unsound. Fortunately, the community has rebuilt the structure with improved foundation, wall and roof systems.*
http://www.bellbarn.ca/history.php

Claybank Brick Plant / Korvemaker

Claybank Brick Plant, (1912) near Avonlea SK *- The kilns are no longer used and the soil around the kilns has cooled; this has combined with exceptionally high ground water levels to result in increased dampness and efflorescence on the kilns' brick wall.*
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VISUAL INSPECTION

A planned approach to a heritage project looks at the entire project rather than a series of separate and disjointed decisions about only a few elements. This broader planned approach will mean that early work will be done in a manner that supports rather than obstructs work that might be undertaken in the future.

"In wood framed buildings visible movement is common and as such it should be thoroughly investigated to determine if it is best left as found or corrected. Since masonry buildings are less forgiving relative to movement, the source of the movement should be corrected before any masonry work is completed." Check: cracking at walls, footings, foundation walls, bearing walls, bearing columns, floor joists, beams/headers, connections, drainage, and ventilation. *Practical Preservation Programs, Community Planning, St. John*

12 QUESTIONS WHEN INSPECTING FOUNDATIONS

Movement

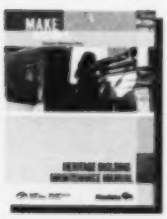
1. Are cracks visible - Some forms of cracking are more serious than others? The level of concern depends on: the size of the crack, the location and direction of the crack and the rate of change of the crack. It is important to recognize and monitor closely any crack movement and have cracks examined by a qualified assessor.
2. Are there signs of movement - cracks re-opening, bulges, windows and doors out of square?
3. Is roofline straight and horizontal?
4. Are beams, columns, posts and joists sound?
5. Are posts vertical and stable?
6. Are foundation walls plumb?

Moisture

7. Are there signs of leaking? What is the source of the water?
8. Any signs of excessive moisture: musty smell, organic growth like lichens or mold, corrosion?
9. Is there any efflorescence or peeling paint on the walls or floor?
10. Are wood posts, beams or floor joists damp or soft?

Exterior

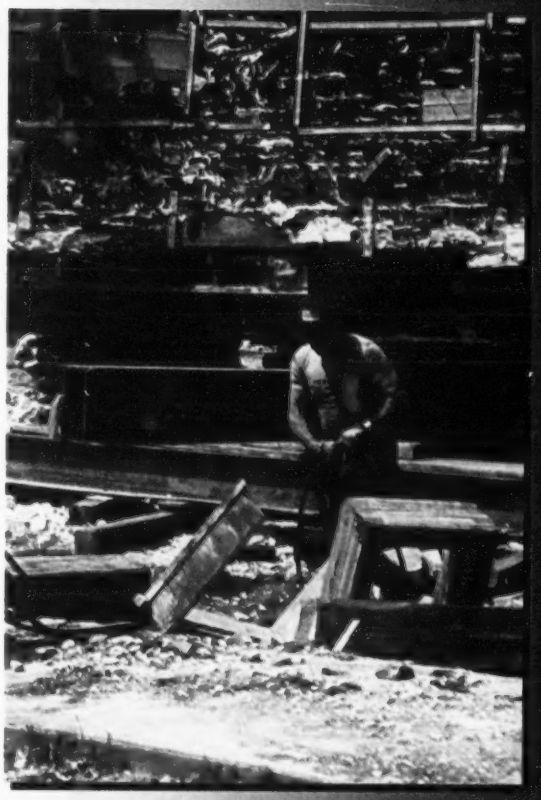
11. Is the parging in good condition? Are there any new cracks or flaking?
12. Are there any trees or saplings growing near the foundation?



Also - is there evidence of mortar deterioration (no mortar, mortar easily scraped away, mortar that has taken on a sand-like texture and crumbles, or mortar that can be easily separated from the brick)

Source: Heritage Building Maintenance Manual
Manitoba Heritage Resources Branch; Culture, Heritage Tourism & Sport http://www.gov.mb.ca/chc/hrb/pdf/maintenace_for_heritage_bldgs.pdf

Projects illustrated in SHF Conservation Bulletins demonstrate the extent to which communities have gone when preserving heritage value. It is important to proceed with a project based on an overall logical plan with complementary short, medium and long-term objectives and goals.



Banbury Residence, Wolseley SK *(1905) built by Edwin Banbury, founder of the Beaver Lumber Company. The brick wall facing was removed prior to relocation of the building across town. The brick was then reapplied and the building restored for use as a restaurant and inn. http://www.banburyhouse.com/*

Banbury Residence, Wolseley SK

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10. Are wood posts, beams or floor joists damp or soft?

Exterior

11. Is the parging in good condition? Are there any new cracks or flaking?
12. Are there any trees or saplings growing near the foundation?

Also - is there evidence of mortar deterioration (no mortar, mortar easily scraped away, mortar that has taken on a sand-like texture and crumbles, or mortar that can be easily separated from the brick)

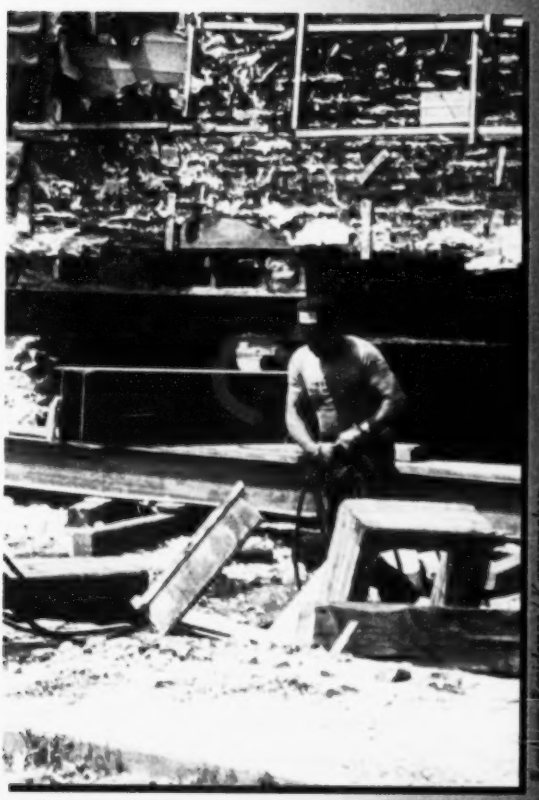
Source: Heritage Building Maintenance Manual
Manitoba Heritage Resources Branch; Culture, Heritage Tourism & Sport http://www.gov.mb.ca/chc/hrb/pdf/maintenace_for_heritage_bldgs.pdf

Projects illustrated in SHF Conservation Bulletins demonstrate the extent to which communities have gone when preserving heritage value. It is important to proceed with a project based on an overall logical plan with complementary short, medium and long-term objectives and goals.

Banbury Residence / Korvemaker

Banbury Residence / Korvemaker

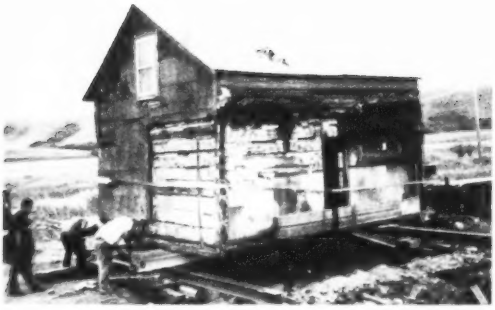
Banbury Residence, Wolseley SK *(1905) built by Edwin Banbury, founder of the Beaver Lumber Company. The brick wall facing was removed prior to relocation of the building across town. The brick was then reapplied and the building restored for use as a restaurant and inn. http://www.banburyhouse.com*



Banbury Residence / Korvemaker

Banbury Residence, Wolseley SK

VISUAL INSPECTION



Ensuring that a foundation rises above grade level to provide clearance between ground cover and the wall structure is an issue sometimes faced in historic buildings, especially smaller structures without basements or crawl spaces. Historic log houses at grade level or on low foundations are also subject to deterioration as noted in the Edwards Log Home (pictured) originally located in the Arm River Valley near Findlater, Saskatchewan. Because the house was built on grade, all bottom logs rotted and required replacement due to water damage.

Foundation repairs require site inspections and in-depth evaluation of issues and their related causes. Following are general comments about a few common foundation considerations:

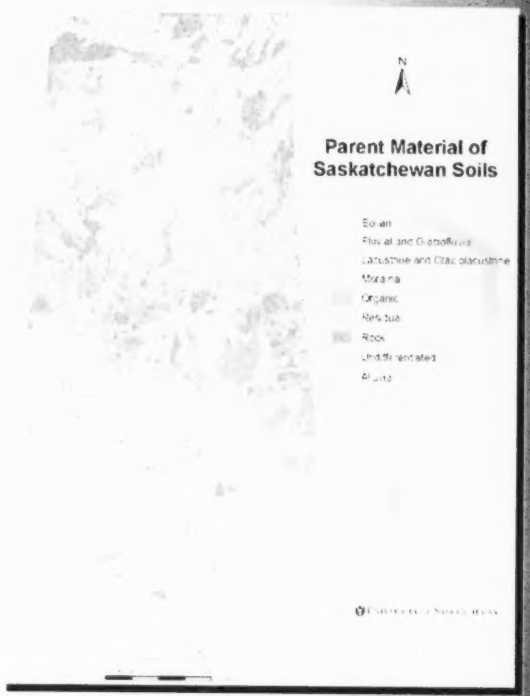
Efflorescence - results from moisture migration through a wall that evaporates and leaves a powdery, usually whitish deposit, on concrete, masonry or other wall surfaces. This residue is composed of mineral salts dissolved from construction materials and soils around the foundation. Efflorescence can be removed by scrubbing with specialized cleaning products and water. However, correction of the problem includes limiting moisture build-up in and around foundations. Treatment might require: exterior excavation around foundation, application of insulation and waterproof membrane materials, installation of a protective cover to prevent membrane damage, installation of an appropriate drainage tile system around the foundation perimeter, and grading backfill away from the foundation with appropriate sand, gravel and soils.

Horizontal cracks - the severity of this situation is influenced by many factors: the presence of lateral pressure and wall buckling due to swelling soil caused by excessive moisture or other site characteristics; location and height of cracking, depth of foundation and related frost heave, loads (vehicle if near driveway, lane or garage); and, the dynamic nature of cracking i.e. is crack moving, degree and frequency of movement (seasonal), direction of movement (vertical, lateral, differential movement).

Vertical, shrinkage, expansion and settlement cracks - does crack widen at the top or bottom, does it radiate diagonally from an opening in the foundation. In addition to foundation replacement, there are many methods of treating crack areas depending on the severity of the situation, including: polyurethane foam, flexible sealants, caulks, grout, bentonite, and other commercial waterproofing and sealant applications.

Bulged foundation repairs - In addition to foundation replacement, other treatments depending on the severity of the situation, include: interior installation of vertical steel I-beams tied to floor joists at the top and anchored to slab or footing at bottom; and pouring new interior and exterior reinforced walls tied to the existing foundation.

Soil Conditions across Saskatchewan vary considerably and effect foundations differently according to the degree of moisture retention. Sandy soil has the ability to drain more effectively than clay soils that are found in areas such as Regina. Water does not readily drain through the clay due to low permeability.



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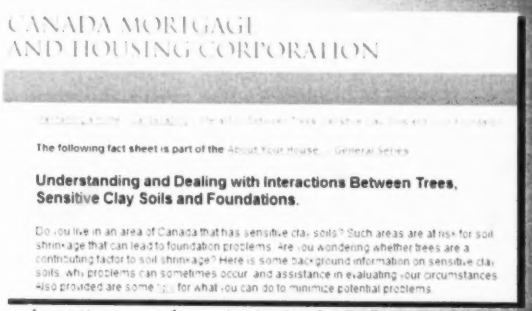
[Dept of Soil Science / U of S]


CANADA MORTGAGE
AND HOUSING CORPORATION

The following fact sheet is part of the About Your House... General Series.

Understanding and Dealing with Interactions Between Trees, Sensitive Clay Soils and Foundations.

Do you live in an area of Canada that has sensitive clay soils? Such areas are at risk for soil shrinkage that can lead to foundation problems. Are you wondering whether trees are a contributing factor to soil shrinkage? Here is some background information on sensitive clay soils, why problems can sometimes occur, and assistance in evaluating your circumstances. Also provided are some tips for what you can do to minimize potential problems.

http://www.cmhc.ca/en/co/maho/la/la_003.cfm

26 Preservation Briefs

Technical Preservation Services
National Park Service
U.S. Department of the Interior

Bruce D. Bomberger

A NOTE TO OUR USERS: The web versions of the **Preservation Briefs** differ somewhat from the printed versions. Many illustrations are new, sections are simplified. Illustrations are typically in color rather than black and white, and some complex charts have been omitted.

The intent of this Brief is to present a concise history and description of the diversity of American log buildings and to provide basic guidance regarding their preservation and maintenance. A log building is defined as a building whose structural walls are composed of horizontally laid or vertically positioned logs. While this Brief will focus upon horizontally-laid, corner-notched log construction, and in particular, houses as a building type, the basic approach to preservation presented here, as well as many of the physical treatments, can be applied to virtually any kind of log structure.

http://www.nps.gov/hps/tps/briefs/presbhom.htm

VISUAL INSPECTION

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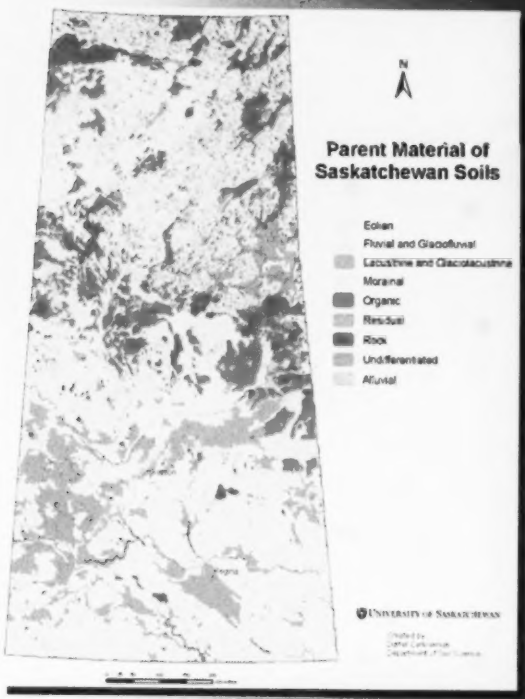

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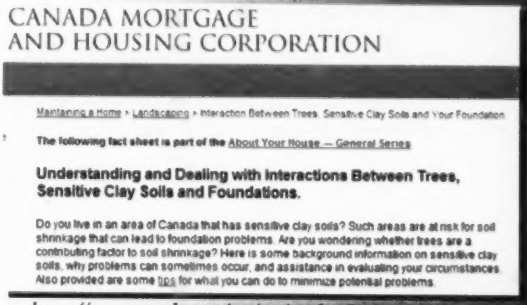
CANADA MORTGAGE AND HOUSING CORPORATION

Maintaining a Home › Landscaping › Interaction Between Trees, Sensitive Clay Soils and Your Foundation

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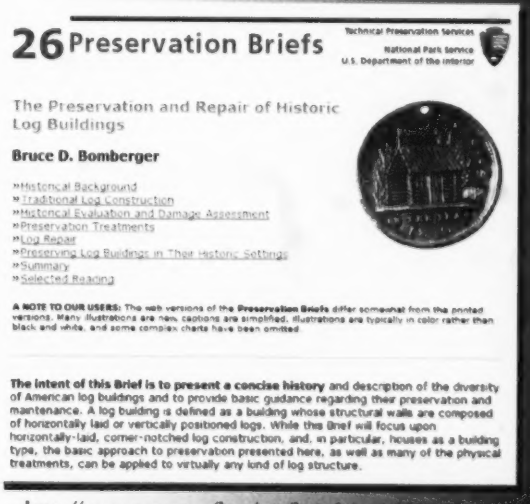
26 Preservation Briefs

Technical Preservation Services
National Park Service
U.S. Department of the Interior

The Preservation and Repair of Historic Log Buildings

Bruce D. Bomberger

- Historical Background
- Traditional Log Construction
- Historical Evaluation and Damage Assessment
- Preservation Treatments
- Log Repair
- Preserving Log Buildings in Their Historic Settings
- Summary
- Selected Reading

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SAMPLE SOURCES

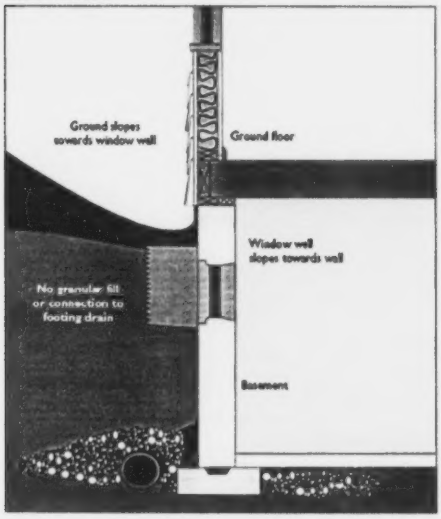
To help readers *focus attention on many of the most common questions and issues related to foundation repair, the forty suggested research topics listed on the page opposite will act as a guide and a starting point for a learning journey about foundation issues and repair methods. Copy and paste these topic titles into an internet search engine to discover thousands of photographs, drawings, articles and videos that are readily available by using these search terms.*

At the time of this writing, an internet search of simple terms such as "foundation repair" and "foundation maintenance" respectively provides 426,000 and 35,000 sources in 0.3 seconds. Almost a half-million sources in less than a second! Other search parameters render similar results. The overwhelming volume of accessible information currently available on the internet would have been inconceivable just twenty years ago. Searching Canadian resources under "foundation crack repair", and referring to American sites such as *The Foundation Crack Bible* by Daniel Friedman at http://www.inspectapedia.com/structure/foundation.htm provide good general information as starting points. However, it is important to remember that your site, location and project will have unique circumstances; products and references in SHF conservation bulletins are not endorsements and projects require consultation with qualified professionals who will need to visit your site, assess the situation and recommend the appropriate treatments.

CANADA MORTGAGE
AND HOUSING CORPORATION

Renovating your Basement — Structural Issues and Soil Conditions

Renovating a full-height basement can add value and extra living space to your house. Even if you don't have a full basement or aren't planning any basement improvements, the foundation of the house is the most important consideration in any renovation. The foundation supports the structure above it and resists the pressure of the soil around it. Fixing any foundation problems before you renovate is essential to preserve the durability and structure of your home.


Ground slopes towards window well
Ground floor
Window well slopes towards wall
No granular fill or connection to footing drain
Basement

http://www.cmhc.ca/en/co/renoho/refash/refash_013.cfm

The Canada Mortgage and Housing Corporation has an informative Fact Sheet Series available at *http://www.cmhc.ca/en/co/co_001.cfm*. In addition to information about foundations, the series addresses several specialized related topics such as Urea-Formaldehyde Foam Insulation (UFFI).

Other sources to start with include:

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National Research Council Canada:

Canadian Inst. for Research in Construction http://irc.nrc-cnrc.gc.ca/pubs/index_e.html

Copy and paste these phrases into an internet search engine

FOUNDATION CRACKING

1. Diagonal cracks
2. Settlement cracks
3. Step cracks
4. Vertical cracks
5. Horizontal cracks
6. Tapered cracks
7. Shrinkage cracks
8. Expansion cracks
9. Thermal expansion cracks
10. Control joint cracks

FOUNDATION MOVEMENT

11. Horizontal movement
12. Vertical movement
13. Frost heave
14. Active and static movement
15. Bulging, leaning and buckling
16. Soil shrinkage impact
17. Freezing & water damage
18. Inspection standards
19. Monitoring crack movement

FOUNDATION SITE CONDIITONS

20. Efflorescence and salt deposits
21. Moisture and mold
22. Waterproofing
23. Basement moisture and mold
24. Site factors affecting foundations
25. Pile foundations
26. Site drainage
27. Building settlement
28. Eliminating exterior water sources
29. Wet basement prevention
30. Radon

FOUNDATION REPAIR METHODS

30. Foundation drains, weeping tile
31. Foundation waterproofing
32. Foundation floor and wall sealers
33. Foundation sealing cracks; polyurethane
34. Foundation waterproof membranes
35. Foundation crack sealants
36. Foundation repair
37. Foundation water entry
38. Foundations, crawl spaces and basements
39. Foundation Insulation
40. Foundation settlement

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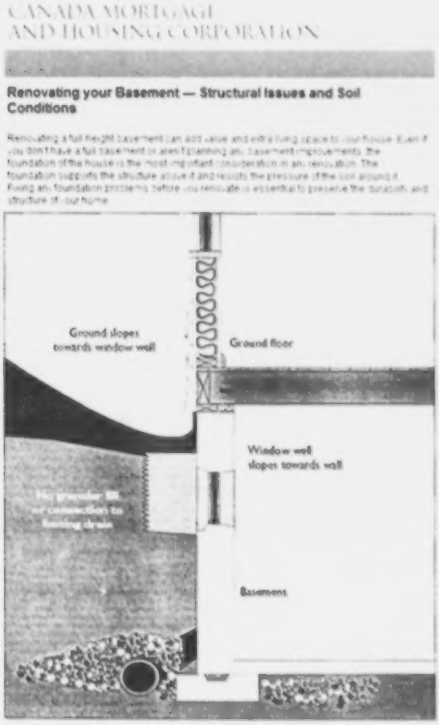

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Typical Vertical Foundation Cracking / Zalmer

Foundation Mold / Korvemaker

USE THIS PAGE FOR YOUR NOTES

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Gov. of Saskatchewan / Zelmer

Exploring basements during early development of the ***"Tunnels of Moose Jaw"*** *gangster era tourism attraction. www.tunnelsofmoosejaw.com/tours.asp*

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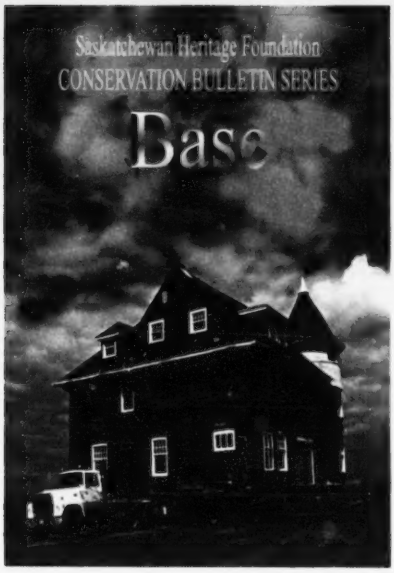
The Saskatchewan Heritage Foundation is the primary agency providing financial support to preserve and restore heritage property in our province.

50% Assistance* for eligible costs related to restoration and repair of designated heritage resources.

**Up to 50% depending on funds available.*
Visit our website for details:
www.tpcs.gov.sk.ca/SHF



Saskatchewan Heritage Foundation

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